DETERMINING THE RATIO OF ACTUAL TO EXPECTED EGGS

OF WESTERN BUDWORM, CHORISTONEURA OCCIDENTALIS

FREEMAN, AT SELECTED SITES IN THE WEST

Date ?

FINAL REPORT

Principal Investigators:

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Corvallis, Oregon

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Activity Number: 1, 2, 7.

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SUMMARY

Populations of pupal exuviae and egg masses of the western spruce budworm were sampled in western Montana, central Idaho, and eastern Oregon. In 20 of 24 populations, the proportion of females among adults was not different from 0.5. Variation in the proportion of females among adults should have a negligible effect on the dynamics of these populations.

Egg mass densities on 45 cm terminal tips were closely related to whole branch densities. Egg mass densities increased from lower crown to upper, and from short trees to tall.

The average number of eggs per mass, which ranged among sites from 23 to 58, was 47.5 ± 10.65.

The number of eggs actually deposited on foliage per adult female ranged among sites from ca. 50 to 900.

INTRODUCTION

Originally, the objective of this work was to determine the ratio of actual eggs produced per expected egg. Expected eggs was defined as the density of adult females times the average number of eggs produced per female. Subsequently, this objective was modified to the following one: to determine the number of actual eggs produced per adult female.

METHODS

Details of all methods used are described in the enclosed manuscripts.

RESULTS

Populations of the western spruce budworm, Choristoneura occidentalis, were sampled in western Montana, central Idaho, and eastern Oregon. In 19 of 24 populations, the proportion of females among pupae did not differ from 0.5. Similarly, in 20 of 24 populations, the proportion of females among adults was not different from 0.5. In all populations, differences between survival rates of male and female pupae were attributed to chance. Variation in the proportion of females among adults should have a negligible effect on the dynamics of these populations.

Host foliage bearing egg masses of the western spruce budworm was removed from sites in Oregon, Idaho, and Montana. In the laboratory, 4,150 egg masses were examined to determine egg mass length and number of rows, number of eggs, number of parasitized eggs, and non-hatch from all other causes. The number of eggs in a mass was smaller at both high and low values of the ratio between egg masses and preceding pupal exuviae per unit of foliage. At intermediate values of this ratio, the number of eggs in a mass increased as defoliation of current-year foliage increased from none to moderate.

The number of eggs per mass was lower in new outbreaks than in stable ones. The average number of eggs per mass, which ranged among sites from 23 to 58, was 47.5 ± 10.65. The rate of egg parasitism was 0.012 ± 0.005, and the rate of egg mortality from all other factors was 0.054 ± 0.004. The number of larvae hatching per egg mass was 44.362 ± 9.942. Relations between egg mass dimensions (length and number of rows) and eggs per mass was quite consistent within a place, but could differ dramatically between places.

Egg masses of the western spruce budworm were counted on a total of 4,794 sample branches drawn from host trees in northcentral Washington, eastern Oregon, central Idaho, and western Montana. Branches were drawn from the lower, mid, and upper crowns of trees 4-7m, 7-14m, and greater than 14-m tall. Across all crown strata, tree height classes, and egg mass densities studied, densities on 45 cm terminal tips were closely related to whole branch densities. Egg mass densities increased from lower crown to upper, and from short trees to tall. Average egg mass densities on 4-14m tall trees were a linear function of densities on mid crown terminal tips of trees in this same height class. Average egg mass densities on trees greater than 14m tall could be described as linear functions of an index of current defoliation and either densities on mid crown terminal tips of 4-14m tall trees or densities on lower crown terminal tips of trees greater than 14m tall. Without the index of defoliation, average egg mass densities below ca. 2 egg masses per square meter of foliage on the mid crowns of 4-14m tall trees could provide serious underestimates of densities on the taller trees. A sampling

scheme based on the above relations is presented for estimating egg mass densities of the western spruce budworm. None of the above relations differed between Douglas-fir and grand fir, the two host species studied.

The number of actual eggs (N_E) produced per adult female ($N\female A$) ranged among sites from ca. 50 to 900. N_E proved to be the following function of $N\female A$ and an index of defoliation(Def):

$$N_E = 125.22(N\female A)^{0.7045} (Def)^{0.769}.$$

CONCLUSIONS

The number of eggs produced per adult female is hightly variable. Much of this variability is induced by interstand redistribution of the adult females.

WORK REMAINING ON STUDY

Work is now in progress to relate variation in the number of eggs produced per adult female to variation in other environmental variables.

COOPERATION AND COORDINATION

Cooperation and coordination with three U.S. Forest Service Pest Management Offices (R1,4,6) has been excellent.

PROBLEMS ENCOUNTERED

Tne phenomenon observed (redistribution of adult female budworm)
appears to occur across large areas--possibly 10,000 mi^2, or even
more. Such large scale phenomena are inherently difficult to observe,
quantity, and model.

MANUSCRIPTS

Campbell, R.W., T.R. Torgersen, K. Hosman, and N. Srivastava. Sex ratios
of tie western spruce budworm. For Canad. Entomol.

Campbell, R.W., N. Srivastava, T.R. Torgersen, and R.C. Beckwith.
Sampling tne western spruce budworm: egg masses. For For. Sci.

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survival rate of eggs in egg masses of the western spruce budworm.
For Canad. Entomol.